

The role of new technologies in competence teaching in higher education: The case of accounting*

M^a Del Mar Marín Sánchez, Alicia Mateos Ronco

(Business and Management Administration Faculty, Universidad Politécnica de Valencia, Valencia 46022, Spain)

Abstract: The Spanish educational system will require certain changes in order to achieve the Bologna objectives for the European Higher Education Area, including a more professional profile, with new activities and roles for both students and teachers, who must assume new skills that will affect concepts and attitudes related to the teaching and learning processes within the framework of training projects. However, students must also take a leading role in the educational process by adopting independent, meaningful and cooperative learning methods. This process will imply a notable change of mindset for the typical Spanish students and will involve a high degree of collaboration between students and teachers. Teachers will have to choose suitable methodologies for achieving those objectives, within the academic framework and considering the characteristics of professional training in skills. In addition, they must create the appropriate structural and organizational conditions to carry out these activities (class size, space, educational organization, etc.). This paper describes the authors' experience in designing learning methodologies for the teaching of accountancy in the business administration degree course at the Polytechnic University of Valencia. The paper is divided into three parts. The first part describes the methodology designed for teaching accounting, based on PBL (problem-based learning), compiled with Internet-based technologies. We analyze its use and evolution in two accounting subjects in the first and the fourth years of the degree. The second part presents the results for each subject in these years. The authors also point out the differences between students who chose the learning methodology described and those who used the traditional approach. The final part of the paper presents the conclusions obtained from the statistical treatment of the results and the analysis of different options for correlating the information obtained. These results show that there is a direct correlation between the use of an active learning model—through the teaching methodology—and obtaining satisfactory exam results in the subject. Finally, the authors analyze these results and consider how they should be used for evaluating the suitability of the methodology and to determine whether it is necessary to redesign the methodology to fit in with the characteristics, conditions and limitations of the teaching and learning processes.

Key words: accounting; higher education; TIC; problem-based learning (PBL); competences

1. Introduction and objectives

The Declarations of the Sorbonne (1998) and Bologna (1999) established a starting point for the

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M^a Del Mar Marín Sánchez, Ph.D., professor, Business and Management Administration Faculty, Universidad Politécnica de Valencia; research fields: accounting research, e-learning methodologies.

Alicia Mateos Ronco, Ph.D., professor, Business and Management Administration Faculty, Universidad Politécnica de Valencia; research fields: accounting research, e-learning methodologies.

harmonisation program of the different European higher education systems. The process called for the adoption of a single European degree system to improve the employment prospects of graduates and to make the European higher education system more competitive internationally. Harmonisation of the European Higher Education Area (EHEA) is expected to be complete in 2010. In Spain, the Organic Law of Universities passed in 2001 foresaw the complete integration of Spanish higher education into the EHEA and since then radical changes have taken place in the structures of Spanish undergraduate and postgraduate degree courses.

In this context, achieving the Bologna objectives and establishing the high standards of the European Higher Education Area require the reform of the educational system, the development of a professional profile and roles and activities different from the traditional ones for both teachers and students (Monereo & Pozo, 2003). The latter will have to take on new competencies that will influence their concepts and attitudes on teaching and learning within the framework of learning projects (Zabalza, 2003). Students will also have to take a leading role in the educational process by adopting significant and cooperative autonomous learning methods.

The process will doubtless require a profound change in the mindset of the dominant culture of both students and teachers, with a higher degree of cooperation between both, aiming at improving learning results. Teachers will have to select the appropriate methodologies to achieve the required results by using as a reference the professional academic profile and the characteristics of training in skills (Argüelles, 1997; Cañibano, 2008), as well as the structural and organisational settings in which they will be carried out (class size, space, educational organization, etc.).

This paper describes the teaching experience acquired by the authors in designing learning methodologies for application to one of the social sciences (Ballesterro, 1980), i.e., accountancy, in the business administration degree course at the Universidad Politécnica de Valencia.

The teaching methodology is based on problem-based learning (PBL) and intensive use of information and communication technology (ICT) provided by the computer-based educational platform of the university. The experience involved two accounting subjects considered to be among the most important in the first and second cycles, respectively, of the degree course, involving a large number of students. In both cases, students were free to design their own individual learning systems.

The fundamental objective of this work is therefore to evaluate the results obtained from the teaching-learning process in the subject of accountancy in the business administration degree course by the application of ICT-based teaching methodologies. The analysis of the results obtained shows that there is a direct correlation between the students who opt for an active learning model from the teaching methodology described here and those who achieve satisfactory results in the subject.

This general objective has been divided into three specific parts:

- (1) A description of the innovation in teaching the subject of accountancy by the use of ICT;
- (2) An evaluation of the level of acceptance of the teaching method by students of the first and second cycle, respectively;
- (3) An evaluation of the suitability of the proposed teaching method according to the results obtained by students and the cycle involved.

The work consists of three different sections:

- (1) The first section describes the methodology designed by the authors to teach the subject, its evolution throughout the academic years in which it was put into practice and details of its implantation.
- (2) The second section gives the results obtained in each of the years for each of the subjects considered,

distinguishing between students who adopted the proposed method and those who followed the traditional study method.

(3) Finally, the statistical treatment of the results, together with a discussion and the conclusions are contained in the final section. The analysis of the conclusions will serve as a basis for the evaluation of the suitability of the proposed method and for any necessary changes to adapt it to the characteristics, conditions and limitations of the teaching-learning process.

2. Background

The present study was carried out in the context of the degree course in business administration at the Universidad Politécnica de Valencia. It should be remembered that this university is markedly technical in character, being an aspect which no doubt has an influence on the teaching of business administration and on the type of students who take this course.

The course consists of 327 credits throughout the five years of the course. Students can choose to specialise in one of three sectors: industry, services or construction, a feature which distinguishes it from business studies courses in other Spanish universities.

Subjects included, as previously commented, are the two main subjects of the first (Financial Accounting) and second (General and Analytical Accounting) cycles. It is considered that students must successfully pass the first of these in order to be able to deal with the second.

Table 1 gives a list of the competencies in which students receive training throughout the business degree course.

Table 1 Competencies included in the business administration course

<p>Specific</p> <p>Technical</p> <ul style="list-style-type: none"> • Accounting • Finance • Marketing • Organization/Human resources <p>Environment</p> <ul style="list-style-type: none"> • Economics • Law • Sociology • History <p>Instrumental</p> <ul style="list-style-type: none"> • Math/statistics • Computer systems 	<p>Generic/transversal</p> <ul style="list-style-type: none"> • Foreign languages • Oral and written expression • Creativity and innovation • Communication capability • International environment • Critical thinking • Adapting to change • Working in group/under pressure • Time management • Ethical values <p>Transferable</p> <ul style="list-style-type: none"> • Internships • Real environment simulation
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Source: Cañibano (2008).

In accordance with the White Paper on Business Management and Administration, the specific competencies in which students receive training in the subject of accounting are as follows:

(1) Analysis of financial information for use as a management and decision-making tool;

(2) Use of accounts for the correct understanding of financial information and decision making. The analysis of information is practically impossible without an understanding of this subject;

(3) Capacity to put theoretical knowledge into practice in solving problems, with examples taken from the real business world of the type which the student is likely to have to deal with in his professional career;

(4) Capacity to explain economic questions. An understanding of the subject is necessary to explain to others

economic factors affecting the company;

(5) Use of accounting for an understanding of the present and future impact of financial operations on company capital and assets.

Competence management presents many problems (Levy-Leboyer, 1997), however, new ICT-based teaching methods should provide a stimulus to teachers (Clares, 2005; Guenaga, Celestino & Echegaray, 2003). It should also be pointed out that traditionally both subjects have involved high failure rates and repeated years for many students. This situation means that teachers are continually trying new approaches with the aim of improving exam results.

It should also be pointed out that this course is given in a polytechnic university in which the new technologies are widely used by both teachers and students (Paredes & Estebanell, 2005). For example, the university has an intranet on which students have access to notes, support material, scientific articles, etc., which many other universities still do not have.

An empirical study carried out in 2002 (Celestino, Echegaray & Guenaga, 2002) demonstrated the generally low level of incorporation of webs and their contents for support in the important subjects of financial management and computer applications for management in business faculties in other Spanish universities.

A study carried out by the Basque Country University in 2003 (Clares, 2005) concluded that the new technologies could become the key to making a decisive contribution to the quality of training by improving individual, group and team work and the incorporation of new evaluation methods.

In the case of the Universidad Politécnica de Valencia, the academic year 2002/2003, a web-based educational platform was put into operation to facilitate and stimulate new work strategies by means of forums, chat rooms and new ways of evaluating students' performance. It proved to be so successful that it inspired the researchers to begin the present work in order to verify to what extent results were improved in the subject both in the first and second cycles.

Table 2 Teaching program of subjects analysed: Business studies degree course—UPV

1st S	Business law	Basic mathematics	Optional	Microeconomics	Introduction to business sectors	
2nd S	Financial accounting	Introduction to statistics	Economy of business I			
7th S	General and analytical accounting	Econometrics	Quality control	Integrated business computer system	Specialisation	Optional
8th S	Business management	Production management and logistics	Cost management	Import and export management	Languages II	Optional

Source: Compiled by the authors.

3. Teaching methodology

The description of the teaching methodology applied to these two important subjects will assist the researchers in reaching the first objective of this study, which consists of describing the innovation project in the use of ICT devices in accounting. Each of the subjects will be described separately in the following sub-paragraphs.

The subject of financial accounting has a total of 7.5 credits and is taught in only one semester of the first year. In 2007/2008, the last year analysed, there were 339 students enrolled in the subject. General and analytical accounting, with 9 credits, is taught in the fourth year and there were 303 students enrolled in the subject in

2007/2008.

3.1 Teaching methodology applied to the subject of financial accounting

The subject is divided into three parts:

(1) Lectures in the theory of the main contents of the subject, worth a total of 2.75 credits;

(2) Practical classes, also worth 2.75 credits, in which students do exercises individually or under supervision;

(3) Practical problem-based learning (PBL) classes (2 credits), in which intensive use is made of ICT systems.

The attention will be focussed mainly on the teaching of these classes and the exams associated with them.

Both of the (1) and (2) aspects are evaluated in the final exam of the subject.

It is important to remember that participation in the practical PBL and ICT based classes in (3) above is voluntary. For those who opt to participate, the final subject mark is calculated as the weighted average of different scores, of which practical classes are given a specific weight of 30% and the others 70%. For those who do not participate in the practical classes, the final mark is made up of 100% of the other scores.

PBL sessions are given in computer-equipped classrooms and intensive use is made of new technologies. In a 2-hour session, using Contaplús software, students must solve a problem consisting of 15 accounting entries without assistance similar to those previously practiced in class. The use of the software program is explained in the first session and practice is provided in its use. The problems increase in complexity with time and are related to the contents of the other two-thirds of the subject.

After the third session, students master the Contaplús program and regard it as a useful problem-solving tool. The aim is to achieve by PBL, the specific skills required for accounting, while at the same time being aware of their many limitations (Barnett, 2001).

ICT systems also come into play since the problems to be solved are often conveyed to students via the university's own educational platform. In the last 20 minutes of the session, students can also use this medium to carry out self-evaluations consisting of 10 multiple-choice questions randomly selected from a total of 50, so that the exam is different for each student. Both students and teachers agree that using the Intranet platform makes this work much easier.

3.2 Teaching methodology applied to the subject of general and analytical accounting

The teaching methods used in this subject are practically identical to those described above, allowing for the fact that students at this stage are expected to have more knowledge and experience. The subject is divided into the following parts:

(1) Lectures in theory, worth 4 credits;

(2) Practical classes, with 3.5 credits, in which the theory is put into practice. Students are given the problems to solve previous to these classes;

(3) PBL-based sessions, with intensive use of ICT systems, worth 1.5 credits.

Students are evaluated in the subject according to the system they opt for, since attendance at the practical classes is not compulsory. If they participate in the practical sessions, which are designed to improve their knowledge and skills in the subject, the final mark is composed of a weighted average of all the students' exams. They may also choose to take only the final exam, whose score will constitute 100% of their final mark in the subject.

Practical classes based on PBL and ICT are given in computer-equipped classrooms. Students are divided into groups of three to analyse the final accounts of a business company they have chosen by themselves. They work as a team in three-hour sessions under the supervision of a teacher. Each team is expected to design its own

computer tools for the financial analysis using Excel software. In the final session, each team delivers a report to the teacher on the situation of the company and recommendations for further action, as well as an oral synthesis of their conclusions.

The students' final scores for the practical sessions are composed of a weighted average of the score given for the final report and analysis (60%), the score for the Excel application designed for the calculations (10%) and the oral exegesis of the conclusions (30%).

The use of this methodology initiates students in the habit of working as part of a team (Katzenbach, 2000) and trains them in problem solving and the use of new technologies. Besides the training, they receive in accounting, it also improves their oral and written expression skills.

4. Results

The results obtained by students who studied this course between 2002/2003 and 2007/2008 will be used to determine whether the objectives proposed in this study have been reached. Students' acceptance of the methodology will be evaluated as well as its suitability for use in teaching the subject according to the results obtained by students and the study cycle which they belong to. The results are presented in the graphs below.

4.1 Results obtained in financial accounting

The authors included the number of students that took part in the six years under study from 2002/2003 to 2007/2008 together with their characteristics.

As can be seen in Table 3, the average number of students in the six years is 330, of which 192 opted to take part in the practical classes using PBL and ICT systems. Of these, 118 managed to obtain a pass in the practice sessions and 66.5% of these also obtained a pass in the subject, while 33.5% did not, as can be seen from Figure 1.

Table 3 Number of students per year who take exams, pass and fail in relation to participation in practical classes

Years	2002/2003	2003/2004	2004/2005	2005/2006	2006/2007	2007/2008	Average
Total students	334	319	322	338	328	339	330
Students examined	247	215	213	239	167	181	210
Students who took part in practice	241	249	157	168	194	143	192
Students who obtained passes in practical work	174	125	65	99	119	128	118
Students who obtained passes in the subject	132	102	53	86	73	89	89
Students who passed with practice	87	71	31	41	39	68	56
Students who passed without practice	3	4	9	10	3	3	5
Students who passed the subject and failed practice	8	23	13	10	4	4	10
Students who failed subject and passed practice	32	53	34	49	60	42	45

Source: Compiled by the authors.

Graph 2 shows the results for the average number of students divided into four groups as follows:

- (1) Students who passed the subject having participated in practical PBL classes;
- (2) Students who passed without participating in practical classes;
- (3) Students who failed having participated in practical classes;
- (4) Students who failed after not having participated in practical classes.

4.2 Results obtained in general and analytical accounting

Using the same methodology applied previously, Table 4 shows the evolution of the number of students and the study methods used by them from 2002/2003 to 2007/2008 (and average numbers for the whole period) in the fourth year subject General and Analytical Accounting.

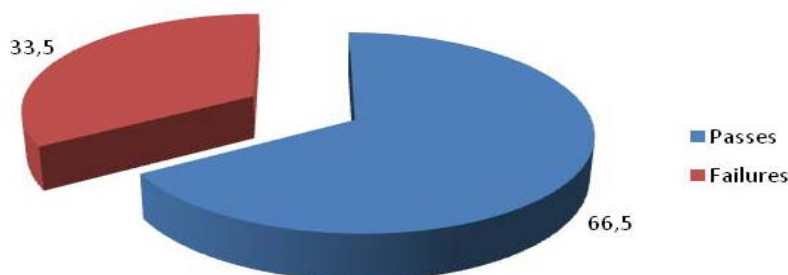


Figure 1 Average percentage of students who pass and fail the subject after obtaining passes in practice carried out with PBL and ICT

Source: Compiled by the authors.

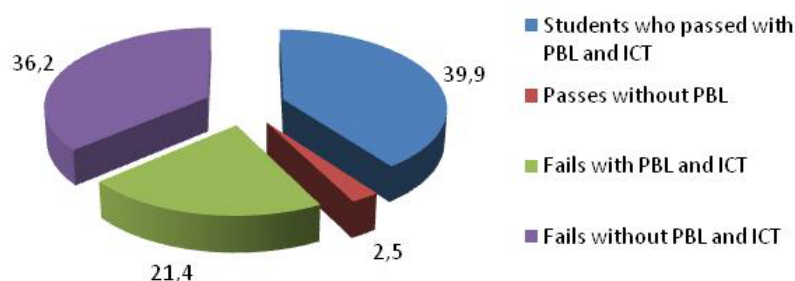


Figure 2 Average percentage of students who passed and failed financial accounting from 2002/2003 to 2007/2008 in relation to whether or not they participated in practical PBL classes

Source: Compiled by the authors.

Table 4 Number of students per year who took, passed and failed the exam in the subject in relation to whether or not they took part in practical classes

Year	2002/2003	2003/2004	2004/2005	2005/2006	2006/2007	2007/2008	AVERAGE
Total students	187	254	289	310	320	303	277
Students examined	119	179	204	202	206	175	181
Students who took part in practice	140	177	179	145	115	173	155
Students who obtained passes in practical work	125	167	173	145	115	171	149
Students who obtained passes in the subject	46	76	83	110	89	76	80
Students who passed with practice	41	75	76	86	66	66	68
Students who passed without practice	5	1	7	24	23	10	12
Students who passed the subject and failed practice	0	0	1	0	0	0	0
Students who failed subject and passed practice	63	76	85	35	37	66	60

Source: Compiled by the authors.

The Figure 3 and Figure 4 show that a significant percentage (56%) of the average number of 277 students took the active learning option (86% of those who sat the final exam). Of those who passed, 85% took part in practice classes (see Graph 3), while no student who obtained a negative mark in practice managed to pass the final exam in the subject.

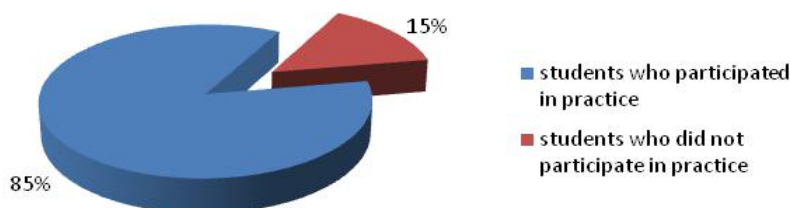


Figure 3 Average percentage of students who used active learning methods and also achieved a pass in the subject General and Analytical Accounting in the years 2002/2003 to 2007/2008

Source: Compiled by the authors.

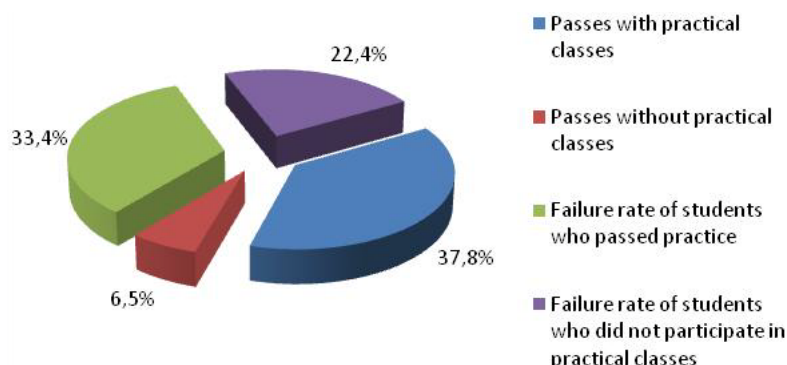


Figure 4 Average of passes and failures in General and Analytical Accounting in relation to learning method for the years 2002/2003 to 2007/2008

Source: Compiled by the authors.

4.3 Analysis of the results

The results obtained in this study show a remarkable correlation between the pass rates of students and whether or not they participated in practical classes, demonstrating that those who did participate achieved much higher pass rates.

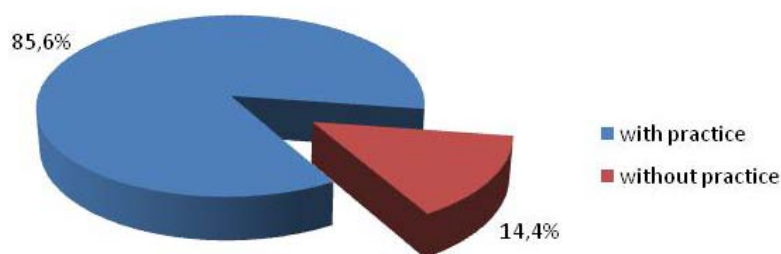


Figure 5 Average percentage of students who voluntarily used PBL with ICT in General and Analytical Accounting from 2002/2003 to 2007/2008

Source: Compiled by the authors.

However, the results also show that the relationship between practical classes and success rate cannot be demonstrated for a part of the student sample. This is probably due to the lack of sufficient computer terminals in the classrooms, since students have to share computers with classmates, thus giving the less motivated the opportunity to take advantage of the work of their more highly motivated classmates. We foresee improvements in future teaching methods to overcome this problem.

It has also been noted that the students who become accustomed to active PBL and ICT based learning methods in the first two years continue to use them throughout the remainder of their university career, with a high

participation rate in active learning methods (see Figure 5).

5. Conclusions

The application of active methods in the first year of the university degree course with an average number of 120 students per group (300 in total) is regarded with certain apprehension by many lecturers, and even more so in important subjects considered to be difficult with high failure and dropout rates. The authors therefore regard the results of this study as important for the following reasons:

(1) Exam results improved significantly among the sampled students who actively followed practical learning methods coupled with the use of ICT technology, which encourages the teachers to continue with the task of expanding their use.

(2) An analysis of the evolution of the students throughout their degree course in Business Administration and Management attempts to correlate the first year exam results in the subject with those from the fourth year, when students are supposed to have greater knowledge of the subject. This evolution had never been systematically dealt with prior to the study. The conclusions reached, which point to the higher success rate among those who participate in ICT-based methods, support the conviction that the use of such methods should be encouraged.

(3) Finally, the present study is an analysis of the situation in regard to the teaching of the two subjects involved and describes quantitatively and systematically the results obtained. It is considered that they amply demonstrate that they are suitable for use in subjects with similar contents at higher levels. The researchers also consider this aspect to be of special importance in the present context of change which Spanish universities are currently experiencing, involving changes to degree structures in order to harmonise with the European Higher Education Area.

These conclusions reinforce the commitment to these methods and have encouraged the teachers to continue the work of improving them and sharing the results with other universities and teachers working in similar conditions.

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